



PROCEEDINGS

INTERNATIONAL FOOD CONFERENCE 2016

“INNOVATION OF FOOD TECHNOLOGY
TO IMPROVE FOOD SECURITY AND HEALTH”

Surabaya, 20-21 October 2016

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October 20 – 21, 2016

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Surabaya – Indonesia**

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Faculty of Agricultural Technology, Widya Mandala Catholic University Surabaya
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PREFACE

Honorable and Distinguished Guests, Ladies and Gentlemen,

First of all, I would like to thank God the Almighty Father, for pouring His grace and blessings upon our lives. Especially, on this very special occasion, Thursday, 20th October 2016, we all gather here on the 2nd International Food Conference 2016 with the following theme “Innovation of Food Technology to Improve Food Security and Health”. This great scientific event is held by the Faculty of Agricultural Technology, Widya Mandala Catholic University Surabaya (WMCUS), in collaboration with the Indonesian Association of Food Technologist (PATPI) Surabaya Chapter, P3FNI and is also supported by the Indonesian Society for Lactic Acid Bacteria (ISLAB), Pergizi Pangan Indonesia, and Asosiasi Profesi Keamanan Pangan Indonesia (APKEPI).

Therefore please allow me to express my sincerest gratitude and highest appreciation to all aforementioned parties which have actively expressed their strong care, commitment, and enthusiasm in handling various issues related to health promotion and well-being of the society through food consumption. This is, indeed, aligned with the theme of 56th Anniversary of WMCUS, namely “Together with all nation’s components, the University is strongly committed to establish a competitive Indonesian Golden Generation”.

I believe this scientific meeting will provide a great opportunity for researchers and industry practitioners to disseminate and discuss their latest research innovation and findings in the areas of food technology, health, and food securities. This will result in strategy formulation to overcome problems related to the above fields. I hope this meeting may also expand and strengthen the collaboration between academia and industry practitioners.

Through this important event, food technology may be proven to become one of important contributing factors in promoting the quality of human lives. Ultimately, our nation’s competitiveness will be enhanced and Indonesia will be more respected by other nations in the global era. May we continuously strive for excellence in our professional lives to serve the community at large so we may become the sign of God’s presence and love.

May God bless us all !

Surabaya, 20th October 2016

Rector

Drs. Kuncoro Foe, G.Dip.Sc., Ph.D.

INTRODUCTION TO THE SEMINAR

Honorable guests, ladies and gentlemen

First of all I would like to welcome you all in this beautiful city of Surabaya, Indonesia. We are delighted to have you here to meet and to share our knowledge, research, and discuss latest trend in the area of food technology and nutrition. The topics of our International Food Conference 2016 is “Innovation in food technology to improve food security and health” and this year is the second edition of the conference after successful first edition in 2011.

As we already aware that the field of Food Technology is growing rapidly and its development is making a great impact on the health and wellbeing of the society. Food technology covers wide range of area starting from the simplest food preservation such as sun drying, post harvest handling to reduce losses, to the advanced nanotechnology for functional food application. Therefore food technology has become one of the most important contributors in human life. Nowadays, food technology are not only intended to fulfill the foods needed for daily consumptions, but has also been an important factor playing role in combating health problems in the world. Research on health problems of the society has been polarized into two groups which are health problems because of malnutrition and health problems due to over nutrition and unbalanced dietary and lifestyle habit.

The aim of this conference is to provide forum for researcher and industries to disseminate their latest research innovation in food technology, health, and food security, create opportunities for researcher to discuss health and food security problems around the world as well as the strategy to manage such problems and also Strengthen the collaboration between universities and industries by designing an event for researcher and industries to gather and discuss opportunities for collaborations.

The participants including invited speakers are coming from different countries such as Australia, Malaysia, Vietnam, Italia, Nigeria, and Indonesia. There are total of 81 papers presented in both oral and poster presentation.

We would like to express our sincere gratitude to all of the invited speakers Ibu Tetty Sihombing from BPOM, Prof Son Radu, Dr. Peter Sopade, Prof. Endang Sutriswati, Prof. Hany Widjaja, Ir. Indah Kuswardani, Prof. Rindit Pambayun, Prof. Achmad Subagio, Prof. Anang Legowo, Dr. Tyas Utami, Dr. Agustin Wardani, Prof. Nuri Andarwulan, Mr. Lino Paravano, Prof Hardinsyah, and Prof. Marsono. We would like to express our gratitude to P3FNI and PATPI Surabaya for the assistance in preparation for this conference.

We would also like to thank our sponsors that made this event possible. Last but not least, I would like to thank all members of organizing committee for their full supports and commitments in preparing this conference. I wish that all of us will have a fruitful discussion and for all of you having a pleasant stay in Surabaya. Thank you.

Warm regards

Ignasius Radix AP Jati
Chair of Organizing Committee IFC 2016

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The Improvement of Nutritional Value of Analog Rice from Lesser Yam Tubers (*Dioscorea esculenta* L.) Enriched with Soybean Flour

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Abstract

The research to produce of analog rice had been conducted in the previous year with extrusion techniques. The most preferred analog rice by consumers was made from the proportion of lesser yam : mocaf flour 90%:10% using 2% of carrageenan. In addition to the availability of rice as staple food, problem in Indonesian population is lack of protein intake, which lead to malnutrition especially in toddlers. One solution to fight malnutrition is adding important nutrients into food, which commonly called fortification. The fortification can be made by coating and premix/mixing. The fortifications by coating on the surface of the rice grains were judged ineffective because it would be loss when washed and soaked. Therefore, this research was done by fortification on analog rice by mixing with soybean flour. The aims of fortification is to improve the nutritional value of protein in analog rice produced. The addition of soybean flour on this research were 0%, 1%, 2%, 3%, 4% and 5%. The data obtained were analysis by ANOVA. If there was a noticeable difference between the treatments, further analysis with LSD (Least Significant Different Test) were carried out. The results in this research showed that increasing the addition of soybean flour can increase the nutritional value of protein in analog rice from 6.704% to 8.098%. The addition of soybean flour cause a decrease starch levels in analog rice from 85.582% to 84.108%, while increased amylose from 19.514% to 20.05% and declined of amylopectin from 66.069% to 64.057%; an increase of the rehydration power on analogue rice were found from 34.44% to 53.33%; an increase of expansion of volume were measured from 165.56% to 177.78%. The highest sensory score of analog rice was the treatment F3 wick the score of color is 3.35, taste is 2.95 and texture is 2.40.

Keywords: analog rice, fortification, lesser yam, soybean

Introduction

Lesser yam (*Dioscorea esculenta* L.) is one of the many local species of plants grow in various regions of Indonesia, and usually found as wild plant in the garden and in the forests. The tuber of this plant is usually utilized as a source of carbohydrate as an alternative of rice, but the utilization is still very limited. The superiority of lesser yam compared to other crops are easily grown on non-irrigated land and the critical land, without intensive farming and also can be grown as intercrops (Gsianturi, 2003).

Tubers are generally contain high levels of carbohydrates, but low protein content compare with cereals. Because of the high content of carbohydrates, these tubers known simply as a cheap source of calories. In addition to the primary function as a source of carbohydrate and calories, tubers are also contain bioactive compound and micronutrients.

Development of analog rice from lesser yam tubers is one effort to create an innovation based on

local food source available, and providing alternative food that is cheap and nutritious, so it can be beneficial to strengthen food self-sufficiency. Previous research that has been done were development of analog rice from lesser yam tubers using seaweed and carrageenan as ingredients (Winarti, *et al.*, 2016a), as well as the development of analog rice using mocaf flour (Winarti, *et al.*, 2016b). In this research, the analog rice was made from lesser yam tuber and were fortified with soybean flour to increase nutritional value of the product.

In addition to the availability of rice as staple food, problem which arise in Indonesian population is the lack of protein intake, leads to malnutrition especially in children. Solution to the problems is by adding nutrients into food, which commonly called as the fortification. The fortification can be made by coating and premix/mixing. The fortifications by coating on the surface of the rice grains were known as ineffective because it would be loss when washed and soaked. Thus, the fortification with the premix method becomes one of effective solutions.

The premix method can be applied in the processing of analog rice from lesser yam tubers which then the shape was recreated to be similar with rice. The substance used as fortification agents are trapped in the matrix of analog rice so that it is not lost on the process of leaching. In the process of production of analog rice, binding agent such as alginat, agar and carrageenan can be added for binding the nutrients substance.

The addition of carrageenan is expected to improve the texture of cooked analog rice to become more soft and sticky. The texture, appearance, flavor and color are important parameters and must be observed in the production of analog rice. Some of the ingredients that are added could affect the consumer preferences. The quality of the cooked rice also largely determined by the nature of the physico-chemical of rice such as temperature of starch gelatinization, the volume expansion, viscosity, water absorption and consistency of starch gelling (Purwani, 2001).

The research objective were to determine the effect of enrichment with soybean flour on nutritional quality and consumer preference of analog rice from lesser yam tubers.

Material and Methods

The main material used for this research was lesser yam tubers (*Dioscorea esculenta* L.) which was obtained from the Sawahan, Nganjuk region, East Java. Supporting materials were mocaf, corn starch, soybean flour and carragennan. Meanwhile, the equipment used in this research includes cabinet dryers, single screw extruder, disk mill, plastic strapping, vacuum sealer, soaking tub, strainers, cans and plastic tools.

The procedure of analog rice was as follows. In brief, lesser yam flour was mixed with other ingredients such as corn starch, mocaf flour, skim milk, vegetable oil and GMS. Then, different proportion of soybean flour were added at concentrations of 0%, 1%, 2%, 3%, 4% and 5% from the total weight of the dough and mixed thoroughly until homogeneous. The flour mixture/dough was then formed to granules of rice shaped analog with a single screw extruder (length 1.8 m, with diameter of 2mm) at a temperature of 100°C. Analog rice were then dried at 60°C, for 24 hours.

Hedonic scale scoring test was used to evaluate the sensory quality of cooked analog rice with 20 consumers as panelists. Range value in this test was 1 until 5, in which 1 is dislike it very much to 5

which is like it very much.

Results and Discussion

Protein Content

The results in this research showed that the enrichment of soybean flour gave significant difference effects on protein levels of analog rice ($p \leq 0.05$). The increase of the amount of soybean flour added leads to increase the protein levels on analog rice. The results of the protein content on analog rice is presented in Table 4.1.

Table 4.1. The average of protein levels on analog rice which fortified with soybean flour.

The addition of soybean flour (%)	Protein Content (%)
0	6.704±0.06 ^a
1	6.809±0.02 ^b
2	7.456±0.01 ^c
3	7.906±0.02 ^d
4	8.051±0.02 ^e
5	8.098±0.03 ^e

Note: different letters following the values in each column indicates significantly different ($p \leq 0.05$)

From Table 4.1, it can be seen that the addition of soybean flour can significantly increase the levels of protein on analog rice. This is because soybean contains high levels of protein that is an average of 35% (Koswara, 2009). Moreover, for superior varieties of soybean, can contain protein levels of 40-50%.

Starch, Amylose and Amylopectin content

The result in this study show that levels of starch, amylose and amylopectin on analog rice from lesser yam tubers enriched with soybean flour are different. Starch, amylose and amylopectin content on analog rice is presented in Table 4.2.

Table 4.2. The average content of starch, amylose and amylopectin on analog rice fortified with soybean flour

The addition of soybean flour (%)	Starch content (%)	Amylose content (%)	Amylopectin content (%)
0	85.582±0.48 ^b	19.514±0.6 ^a	66.069±0.93 ^c
1	84.847±0.46 ^{ab}	19.549±0.31 ^a	64.798±0.87 ^{abc}
2	85.330±0.08 ^{ab}	19.581±0.25 ^a	65.749±0.17 ^{cb}
3	84.432±0.34 ^{ab}	19.436±0.26 ^a	64.996±0.08 ^{abc}
4	84.627±0.04 ^{ab}	20.080±0.24 ^a	64.547±0.27 ^{ab}
5	84.108±0.28 ^a	20.051±0.07 ^a	64.057±0.21 ^a

Note: different letters following the values in each column indicates significantly different ($p \leq 0.05$)

The results showed that the addition of soybean flour can effect on the levels of starch, amylose and

amylopectin of analog rice ($p \leq 0.05$). Increasing the levels of soybean flour could significantly decrease the starch and amylopectin contents, though it was not significant for amylose levels (Table 4.2). This is because the material balance of the nutritional value in the ingredients of analog rice. The higher the percentage levels of proteins and other components in a material, leads to the lower the percentage levels of other materials, including the levels of starch. This is in accordance with the opinion of Winarno (2002), which states that the proportion of components in foodstuffs is in balance condition, if one of the components in a material increase then it will cause a decrease in the other components, and vice versa.

Composition of the starch are amylopectin and amylose, both are mutually inversely proportional, that is in food formulation, if the amylose content is increase, the amylopectin levels will decrease, and vice versa. This is in line with the results obtained in this research, which the levels of amylopectin in analog rice decreased by the increase of amylose content.

Rehydration Power

Rehydration power/water absorption of analog rice was determined to know the ability of the rice to absorb water when rice is cooked. Water absorption can also be used to predict the shelf life of analog rice and appropriate packaging methods. Water absorption is influenced by several factors, among others, long-chain of starch, the number of polar groups or hydroxyl groups, the surface area of powder and water content (Hariyadi, 2011).

The results in this study showed that the increase of soybean flour levels were responsible for the increase of the rehydration power, but not significantly different (Table 4.3.). This is due to the fact that the increase of soybean flour cause to the increase of amylose levels on analog rice. Amylose has ability to bind the water easily and also to release again, so analog rice with high amylose levels will easily absorbs water so that increased the rehydration power.

Tabel 4.3. The average of rehydration power on analog rice fortified with soybean flour

The addition of soybean flour (%)	Rehydration Power (%)
0	34.44±0.33 ^a
1	33.33±0.67 ^a
2	34.44±0.67 ^a
3	35.56±0.33 ^a
4	42.22±0.33 ^a
5	50.33±0.67 ^a

Note: different letters following the values in each column indicates significantly different ($p \leq 0.05$)

Expansion Volume

The expansion volume of analog rice is the ability of rice to swell after steaming. Expansion volume has an important role to the quality of analog rice. The mechanism of expansion of analog rice is when rice is soaked in water and heated, the rice will absorb the water and the process of gelatinization of the starch is occurred. Starch properties can trap water to form a three-dimensional network. Therefore leads to the expansion of the volume.

The results from this research show that addition of soybean flour can increase the expansion volume on analog rice (Table 4.4), although do not significantly different. The increase of expansion volume could be caused by the denaturation process of protein from soybean flour when heated. When protein is denatured, it will form a three-dimensional gel which is capable of trapping the water. The protein also has the ability to spontaneously absorb water from the environment containing liquid/water absorption (Joon, 2011).

Table 4.4. The average of expansion volume on analog rice fortified with soybean flour

The addition of soybean flour (%)	Expansion Volume (%)
0	165.56±0.67 ^a
1	167.78±0.67 ^a
2	168.89±0.33 ^a
3	170.11±0.33 ^a
4	171.11±0.67 ^a
5	177.78±0.33 ^a

Note: different letters following the values in each column indicates significantly different ($p \leq 0.05$)

Sensory Quality

The quality of food can be measured by three parameters which are chemical, physical and sensory. The acceptance of food products by consumers is determined by many factors, especially sensory quality. Sensory properties are the properties of the materials scoring by human senses, namely the senses of sight, smell and taste.

The results showed that the highest preference of taste, texture and color of the cooked analog rice by consumer is the analog rice with 3% of soybean flour (Table 4.5). The addition of 3% of soybean flour can enhance the taste due to the protein in soybean flour. The preference on texture could be due to the chewy texture of analog rice enriched with 3% of soybean flour. Heating of soybean protein caused the denaturation of proteins results in the formation of chewy texture. The relationship between the additions of soybean flour with the consumers preference are presented in Figure 4.1.

Table 4.5. Sensory quality on analog rice fortified with soybean flour

The addition of soybean flour (%)	Average of Color	Average of Taste	Average of Texture
0	2.75 ^{ab}	2.35 ^a	2.65 ^{bc}
1	2.45 ^a	2.65 ^a	2.30 ^{ab}
2	2.55 ^a	2.60 ^a	2.50 ^{ab}
3	3.35 ^b	2.95 ^a	3.40 ^c
4	2.65 ^{ab}	2.80 ^a	2.85 ^{bc}
5	2.95 ^{ab}	2.40 ^a	2.10 ^a

Note: different letters following the values in each column indicates significantly different ($p \leq 0.05$)

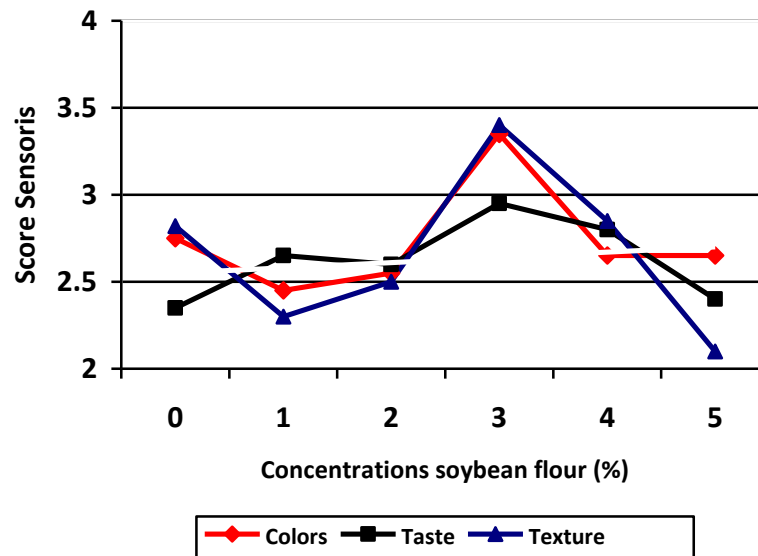


Figure 4.1 The quality of colors, taste and texture on analog rice fortified with soybean flour

Conclusions

The results showed that the increase of soybean flour levels can increase the levels of protein, amylose, rehydration power and expansion volume of analog rice. Starch and amylopectin levels on analog rice from lesser yam tubers were decreased. The addition of 3% of soybean flour on analog rice is the most preferred by consumers.

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